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INT CL[5] B29D

(54) Retreading tires

(57) A process for applying a pre-cured tread stock (62), Fig 2, to a tire carcass 12 in a retreading operation includes rotating the prepared tire carcass 12 on a suitable apparatus 14 and while the tire carcass 12 is rotating a continuous ribbon 517 of cushion gum material is extruded across the crown 12a of the rotating tire carcass 12. The temperature of the cushion gum material must be maintained at a temperature above ambient but below that at which the cure of the cushion gum is initiated. As the ribbon 517 of the cushion gum material 20 is extruded, it is stitched to the tire carcass 12 and a pre-cured tread stock (62) is applied over the cushion gum 20 presented from the crown 12a of the tire carcass 12. Thereafter the cushion gum is cured with heat in order to bond tread stock (62) to the tire carcass 12.

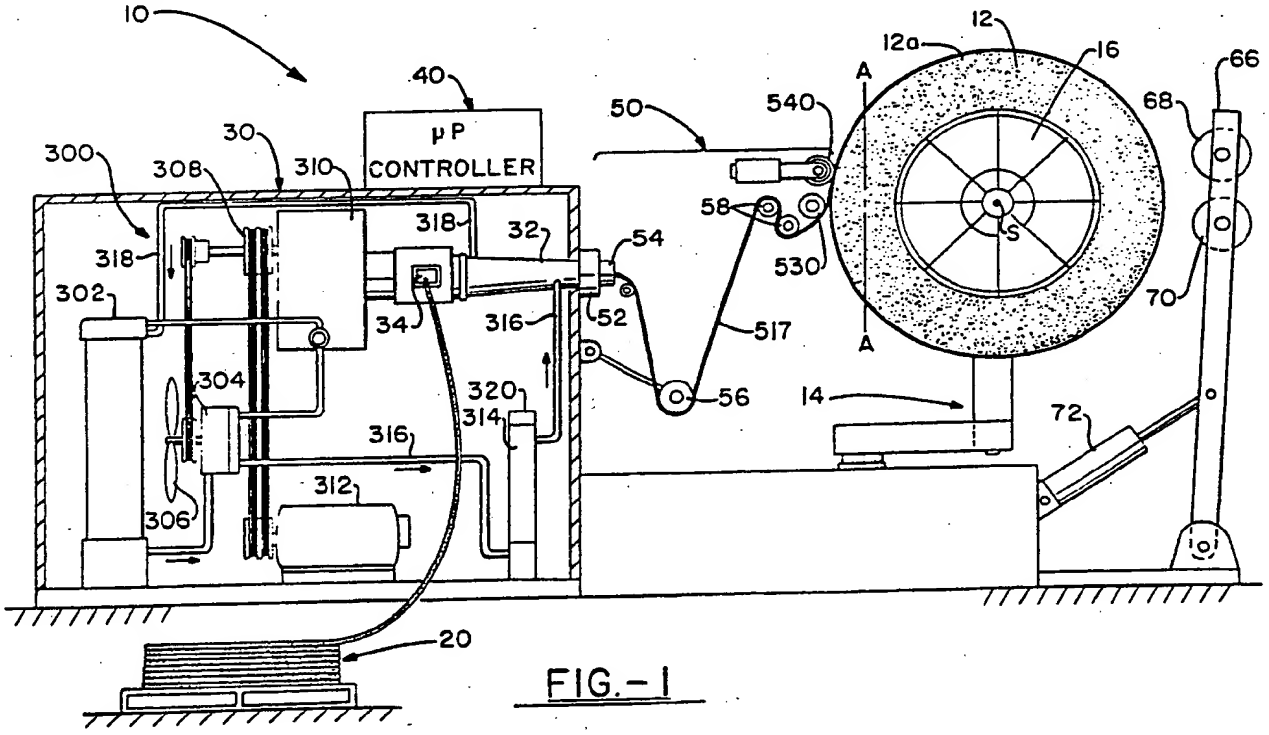

FIG.-1

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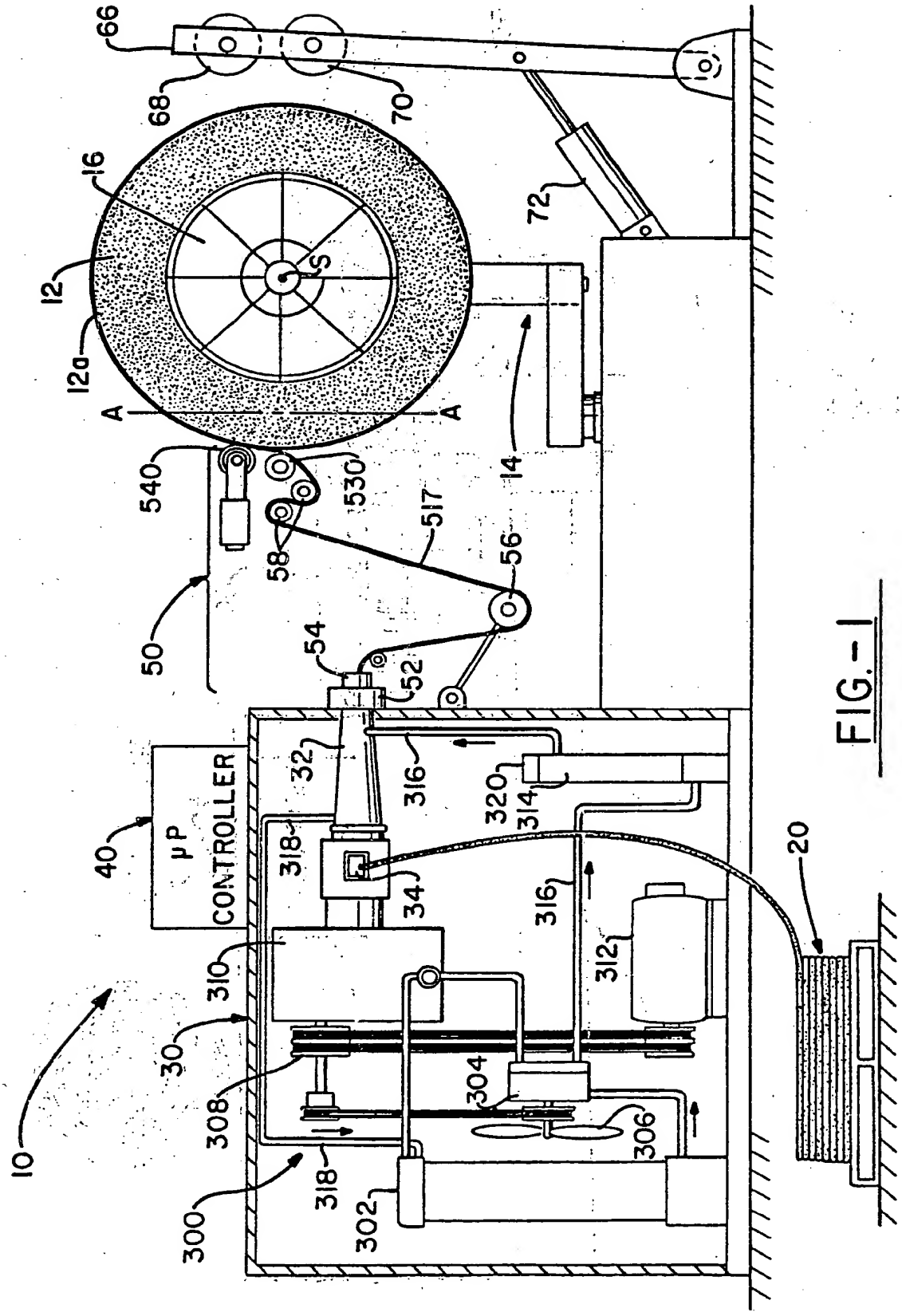


FIG.-1

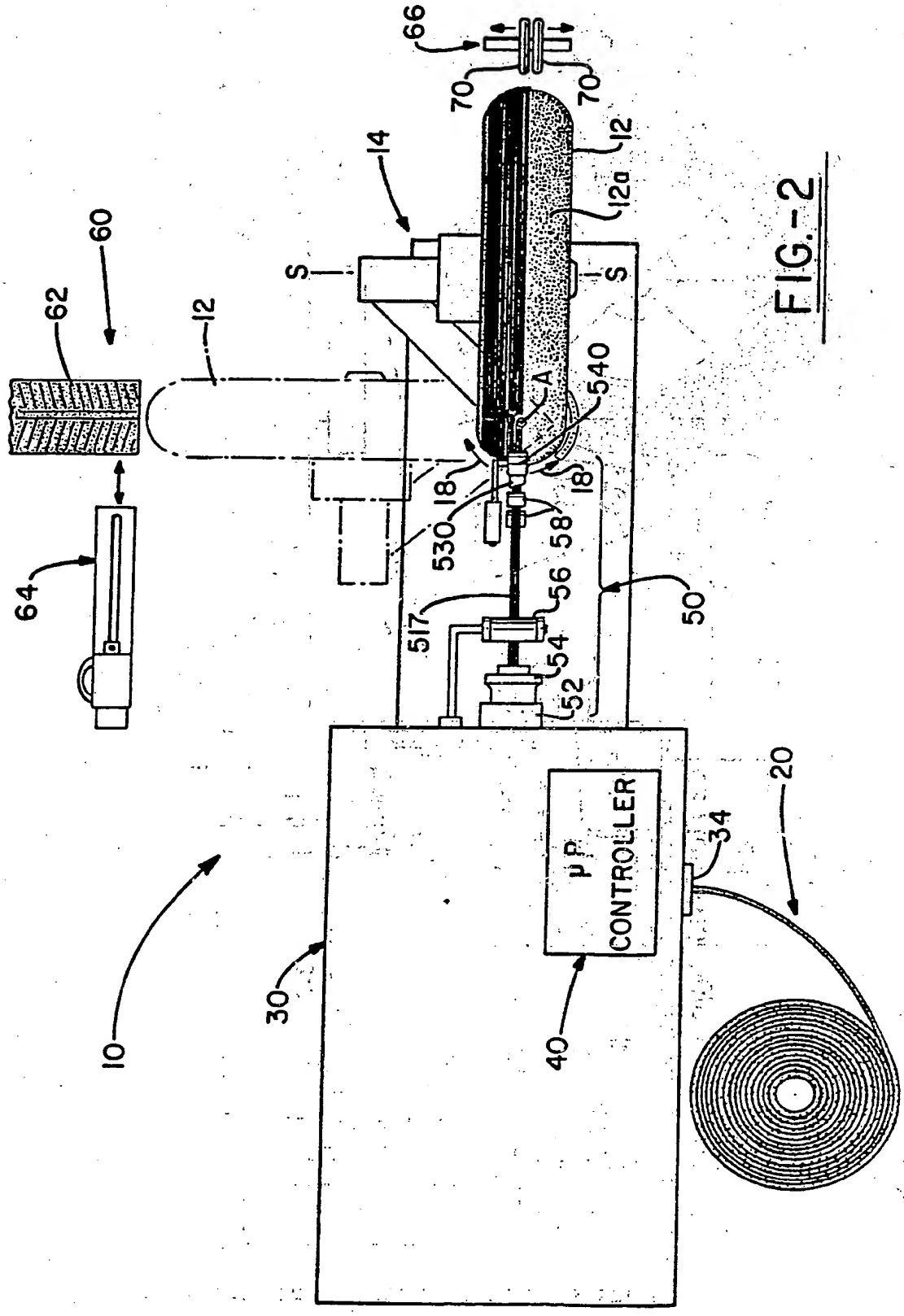
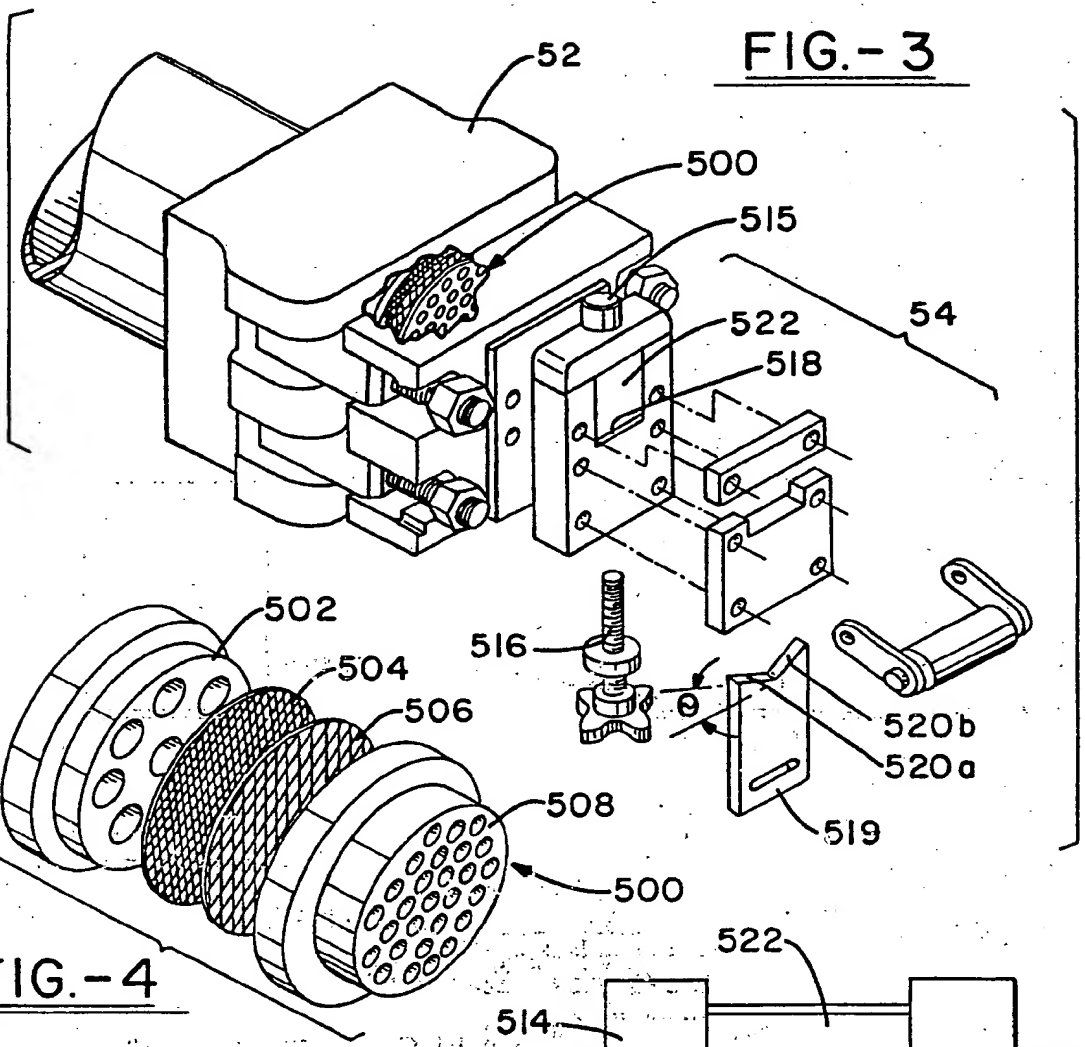


FIG.-2

FIG.-3



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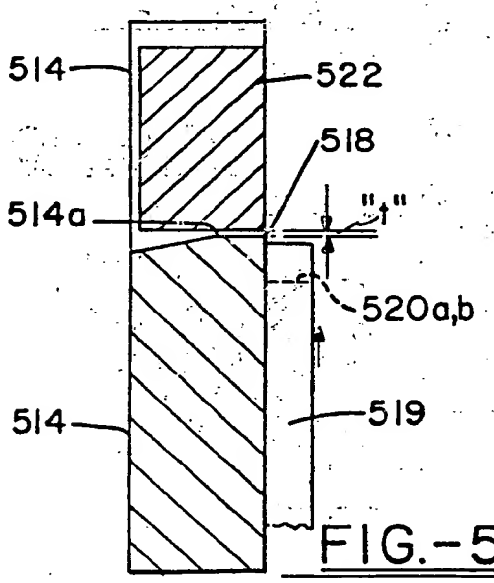

FIG.-5

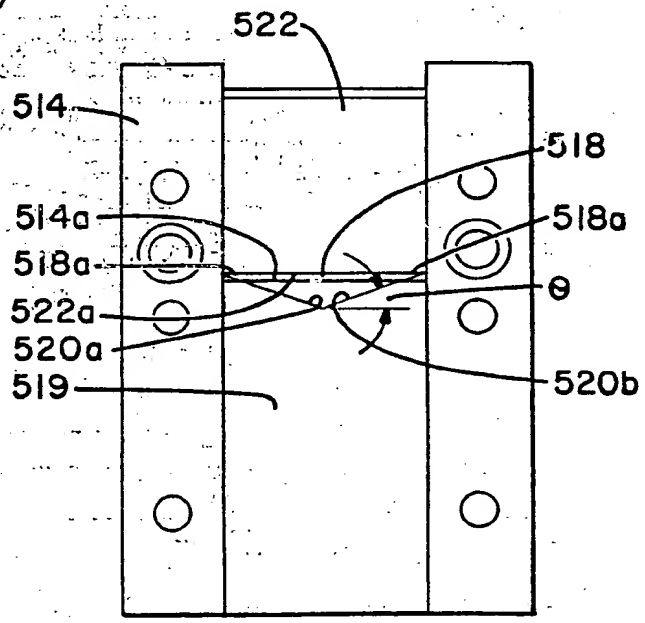

FIG.-6

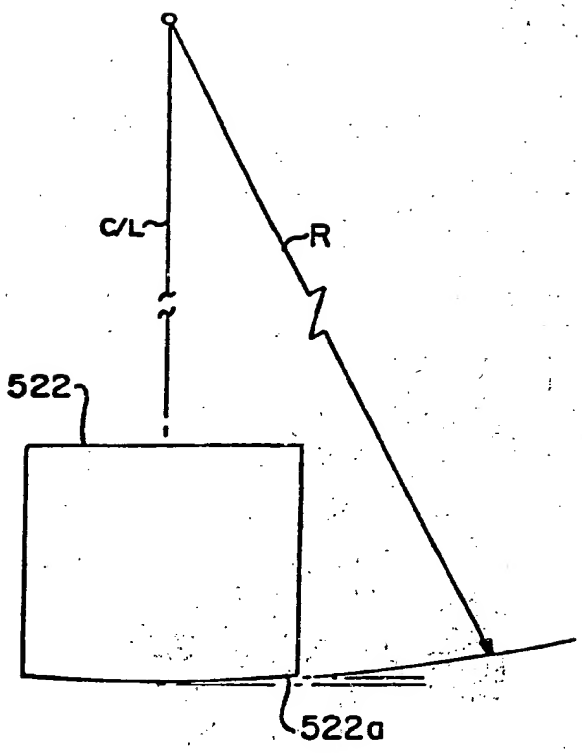

FIG.-7

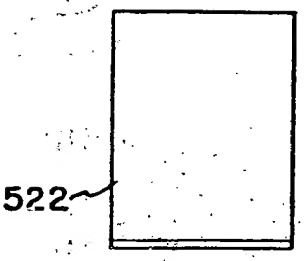

FIG.-8

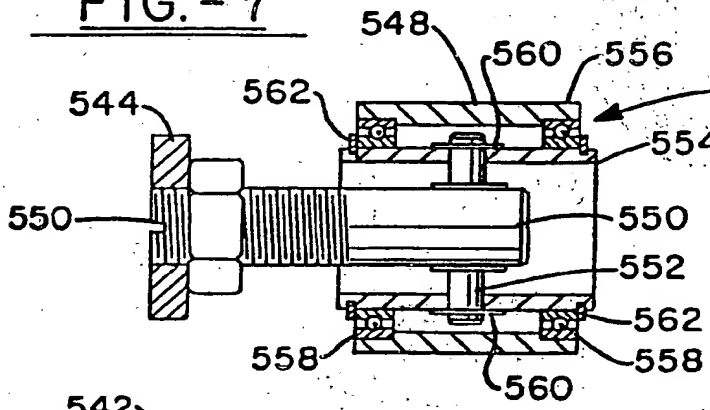

FIG.-9

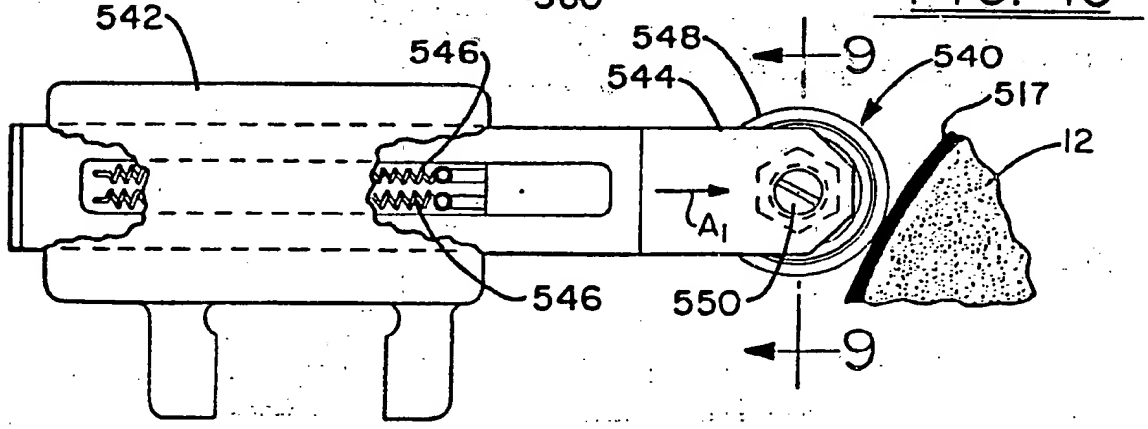

FIG.-10

METHOD AND APPARATUS FOR RETREADING TIRES

TECHNICAL FIELD

The present invention relates generally to tire retreading. More particularly, the present invention relates to a method of retreading a tire carcass wherein a pre-cured tread band is applied to the tire carcass and bonded thereto. Specifically, the present invention relates to a method for applying a hot cushion gum material spirally across the crown of a rotating tire carcass, the temperature of the cushion gum being maintained at, or above, ambient but below that at which curing of the gum material is initiated, and thereafter applying a pre-cured tread band in the manner employed in the "cold-capping" procedure.

BACKGROUND OF THE INVENTION

Presently, the art of retreading tires involves various methods and apparatus and one of these is a "cold-capping" or "pre-cure retreading" operation which includes the following steps:

1. Remove the old, worn, or damaged tread.
2. Buff the tire carcass to provide a textured surface for the adhesion of new tread rubber.
3. Apply a suitable adhesive to the textured carcass surface.
4. Apply a thin layer of a cold, calendered sheet of uncured cushion gum material to the circumferential extent of the tire carcass.
5. Apply a pre-cured tread band over the cushion gum.
6. Cure the cushion gum integrally to bond the tread rubber to the tire carcass.

To use the above-described "cold-capping" method, the cushion gum material has heretofore been pre-manufactured in the form of a calendered sheet. The sheet is slit to various standardized widths and coiled with a plastic release film interposed between successive wraps of the sheet. The prepared coils of cushion gum are maintained in inventory in a wide variety of widths until a need arises for cushion gum of that particular width.

Various problems are inherent in the above-described practice, and they include the need for rigorous inventory control to assure availability of the correct width of cushion gum for each tire carcass that might be encountered. The result is often at odds with the need for a timely turnover of the material in order to avoid deleterious aging of the stock on the shelf. In addition to

aging, the stored coils of cushion gum are also subject to contamination, particularly along the exposed edges of the coiled cushion gum. The coils are also subject to oxidation as well as physical damage during handling.

One proposed solution to the problems found in the present practice of using calendered rolls of cushion gum stock is to limit the number of widths of the pre-manufactured gum stock maintained in inventory and rely on post-trimming of the edges after the cushion gum has been applied to a tire carcass. Such an approach requires that wider-than-necessary rolls of cushion gum be customized to fit the width of several sizes of tire carcasses. Obviously, this proposal suffers not only from being wasteful but also from being labor-intensive.

In any event, the present method of cold-capping with pre-calendered cushion gum requires that the user manually position the leading edge of a single, wide, strip of cushion gum fully across the crown of the tire carcass and then rotate the carcass through one revolution to wind the cushion gum about the circumference of the tire carcass with the release film facing radially outwardly. The presence of the release film tends to preclude contamination of the radially outer surface of the cushion gum, which would occur without the release film if the worker were not careful. The release film also permits the gum to be coiled without the successive layers adhering to each other.

It should also be understood that faulty placement of the leading edge (generally mis-alignment) often requires that the initial portion of the cushion gum sheet be peeled off the tire carcass and be restarted. Of course, this procedure may result in damage to the cushion gum sheet and/or degradation to the adhesion required between the cushion gum sheet and the crown surface of the tire carcass.

Typically, the entire circumferential extent of the tire carcass is wrapped with the cushion gum sheet prior to "cutting-in" the required splice. The cushion gum ply is then roller-stitched to the tire carcass and the release film stripped off in preparation for the application of the pre-cured tread.

An additional problem encountered with the above-described "cold-capping" practice involves the necessity for individual, coiled rolls of calendered cushion gum material for a stated plurality of tire carcasses of a given circumferential dimension. These rolls, while of a specific length for ease of handling, are not usually of an exact length to cover a specific number of tire carcasses, even if the rolls are intended to be for use with an exceedingly common tire size. Thus, short lengths of calendered gum material are generally removed and discarded as excess, thus comprising waste stock. This practice obviously results in an additional cost to the operation.

Other methods and apparatus for retreading tires are available in the industry to those involved in applying uncured tire tread material to a tire carcass in what is called the "hot-capping" procedure. The hot-capping procedure, and an exemplary apparatus for performing that method, are described in U.S. Patents -- No. 3,251,722 and No. 3,177,918 -- to R. G. Holman. According to the "hot-capping" technique, uncured tire tread material is layered onto the crown, and perhaps a portion of each shoulder, of a tire carcass to a sufficient radial thickness that the tire carcass, with the tread material adhering to the circumference thereof, can be received within a mold to form the tread design and to cure the tread rubber *in situ*.

The above-described "cold-capping" and "hot-capping" methods are distinctly different by reason of the type and condition of tire tread stock applied to the tire carcass and they are, therefore, considered non-related, or disassociated, technologies by knowledgeable entities working in this art.

The present invention teaches, for the first time in the retreading industry, that an extruded, hot cushion gum compound may be applied in a continuous spiral across at least the crown of a tire carcass in order to prepare the carcass for receiving a pre-cured tread stock.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of the present invention to provide an improved method for retreading a tire carcass which extrudes a hot, temperature-controlled cushion gum compound to the crown surface of a rotating tire carcass.

It is another object of the present invention to provide an improved method for retreading a tire carcass, as above, wherein a hot cushion gum compound is automatically applied in a continuous spiral across the crown of a tire carcass and immediately roller stitched at the point of application.

It is a further object of the present invention to provide an improved method for retreading a tire carcass, as above, which eliminates splicing of the cushion gum prior to the application of a pre-cured tire tread band about the tire carcass.

It is still another object of the present invention to provide an improved method for retreading a tire carcass, as above, wherein any excess gum material may be easily recycled back through the extruder, thus eliminating the waste of material inherent to the "cold-capping" process hereinbefore described.

It is yet another object of the present invention to provide an improved method for retreading a tire carcass, as above, wherein the hot cushion

gum compound is maintained at a temperature above ambient but below that at which the cure of the cushion gum material is initiated.

Finally, the present invention provides an apparatus which forms, guides, applies, and immediately stitches a ribbon of hot cushion gum compound to at least the crown surface of a rotating tire carcass in a predetermined and programmable width.

These and other objects of the invention, as well as the advantages thereof over existing and prior art forms, which will be apparent in view of the following detailed specification, are accomplished by means hereinafter described and claimed.

In general, an improved method for retreading a tire carcass and embodying the concepts of the present invention mounts the tire carcass on a structure which rotates the carcass. A continuous ribbon of cushion gum material is extruded across the crown of the rotating tire carcass. It is important that the temperature of the cushion gum material be maintained at, or above, ambient but below that at which the cure of the cushion gum material is initiated.

As the extruded ribbon is applied to the crown of the tire carcass it is stitched thereto. This prepares the tire carcass for receiving a pre-cured tread stock over the cushion gum, and thereafter the temperature of the cushion gum can be raised to initiate cure, and thereby bond the pre-cured tread stock to the tire carcass.

One exemplary apparatus capable of performing the method of the present invention is deemed sufficient to effect a full disclosure of the subject invention, is schematically depicted by way of example in the accompanying drawings and is described in detail without attempting to show all of the various forms and modifications in which the invention might be embodied; the invention being measured by the appended claims and not by the details of the specification.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic, side elevation, partially broken away, of apparatus suitable for performing the method of the present invention;

FIG. 2 is a schematic, top plan view of the apparatus depicted in FIG. 1;

FIG. 3 is an enlarged, exploded perspective, partially broken away, of the delivery sub-assembly utilized in the apparatus depicted in FIGS 1 and 2:

FIG. 4 is a further enlarged, exploded perspective illustrating the strainer screens mounted in the delivery sub-assembly depicted in FIG. 3;

FIG. 5 is a vertical section through a preferred die gate housing, and the associated thickness control plate, incorporated in the delivery sub-assembly depicted in FIG. 4, the associated width control gate being partially included for orientation;

FIG. 6 is a frontal elevation of the extruder output gate housing, the thickness control plate and the width control gate depicted in FIG. 5;

FIG. 7 is a frontal elevation of the thickness control plate depicted in FIGS. 5 and 6;

FIG. 8 is a side elevation of the thickness control plate depicted in FIG. 7;

FIG. 9 is an enlarged, vertical section taken substantially along line 9-9 of FIG. 10 to depict a gimballed stitching roller employed in the apparatus depicted in FIGS. 1 and 2; and,

FIG. 10 is a side elevation, partially broken away, of the gimballed roller depicted in FIG. 9 as well as the supporting structure therefor, and, for reference, a representative tire carcass upon which a ribbon of cushion gum material has been wound.

DESCRIPTION OF AN EXEMPLARY EMBODIMENT

One representative form of a tire retreading apparatus employing the concepts of the present invention and operating in conformity with the concepts of the method to which the present invention is directed is designated generally by the numeral 10 on the accompanying drawings.

Referring to FIGS. 1 and 2 of the drawings, a tire retreading station is generally indicated by reference numeral 10. The retreading station 10 includes the apparatus of various sub-assemblies which allow a worker to accomplish the retreading of a tire carcass 12 in accordance with the method to which the present invention is directed. The tire carcass 12 will have had its old tread removed by one of the known methods -- *i.e.*: grinding and/or buffing -- and the crown 12a of the carcass 12 will, therefore, present a textured surface which enhances the adhesion between the tire carcass and the new tire tread, the application of which is hereinafter more fully explained. The tire carcass 12 is mounted on an apparatus 14 which is similar to the apparatus described in the Holman U.S. Patent, No. 3,251,722, previously referenced herein. The tire mounting apparatus 14 provides for inflating and rotating the tire carcass 12. A detailed description of the mounting apparatus 14 may be found in the aforesaid

Holman patent. To understand the present invention it need merely be understood that the mounting apparatus 14 includes an expandable rim structure 16 which mounts the tire carcass 12 for rotation about its normal axis of rotation, as indicated at S-S in the drawings. The mounting apparatus 14 also provides for indexing the tire carcass 12 about an axis A-A which is preferably normal to, but displaced from, the axis S-S (as depicted in FIG. 1), thereby moving the crown 12a arcuately in the direction of the arrows 18 presented in FIG. 2.

Before applying the cushion gum material 20 to the crown 12a of the tire carcass 12, as will be hereinafter more fully described, it is the customary practice to apply a conventional rubber cement, or other suitable adhesive, to the buffed crown 12a of the tire carcass 12.

As best seen in FIG. 1, the work station 10 also generally includes the following: (a) a supply of uncured cushion gum compound material 20; (b) an extruder apparatus 30; (c) a microprocessor controller 40; (d) a delivery sub-assembly 50, which forms, guides, applies and stitches the cushion gum material 20 to the carcass 12; and (e) a tire tread applying sub-assembly 60 (FIG. 2), each of the aforesaid components being hereinafter more fully described to the extent deemed necessary for a full disclosure the operation of the novel method to which the present invention is directed.

Unlike one of the popular, prior known, tire retreading processes which uses calendered sheet cushion gum in a "cold-capping" procedure, the present invention begins with a supply of compounded, uncured, cushion gum material 20 which is delivered to the station 10 in nondescript strips. This form of the cushion gum material 20 is not only cheaper to manufacture and easier to handle than the calendered rolls but can also be processed at the station 10 to provide a continuous supply of cushion gum material 20 for use at the work station 10.

The uncured cushion gum material 20 is fed into a relatively conventional extruder 30 which utilizes a screw housing 32 that presents a port 34 into which the cushion gum material 20 can be fed. The extruder 30 masticates the cushion gum material 20 in a conventional manner, but because the material 20 is an uncured, cushion gum compound, the temperature of the extruder 30 must be controlled to prevent the temperature of the cushion gum material 20 from exceeding its cure initiating level and at the same time permitting a sufficiently elevated temperature for proper mastication and extrusion.

Temperature control of the extruder is accomplished by a heat exchange system, indicated generally at 300. The heat exchange system 300 is itself also fairly conventional. That is, a heat exchanger unit 302 is located where a virtually unobstructed flow of air can be directed thereacross. A pump

304 and a fan 306 can be located in contiguous proximity for operation by a pulley system 308 which is driven by a gear box 310 that is, in turn, powered by a motor 312. A heater 314 is interposed within the feed line 316 which leads from the heat exchanger 302, through the pump 304 and heater 314 and into the customary passageways (not shown) within the screw housing 32 of the extruder 30. A return line 318 communicates from the screw housing 32 back to the heat exchanger 302.

The heat exchange system 300 provides heating, or cooling, fluid to the screw housing 32 in accordance with a thermostatic control 320 that may be mounted within the flow system of the system 300. As depicted, the control 320 may be mounted in proximity to that location in the heater 314 at which the lead line 316 to the screw housing 32 exits the heater 314. The system 300 maintains the temperature of the cushion gum material 20, both within the screw housing 32 of the extruder and as the material 20 exits the screw housing 32, below the level which would initiate, or "set-off", the curatives in the cushion gum material 20. More specifically, the cushion gum temperature is maintained within the range of from about 180° to about 205° F. (approximately 82° to 96° C.) which is below the typical "kick-off" temperature for initiating the cure of the cushion gum material 20 but sufficient to permit effective mastication thereof within the extruder 30 and extrusion thereof onto the tire carcass 12.

The output of the extruder 32 is fed into a delivery means, generally indicated at 50, which functions to form, guide, apply and stitch the hot, extruded cushion gum material 20 to the crown of the tire carcass 12. More specifically, and with reference to FIGS. 3 and 4 of the drawings, the delivery means incorporates a strainer assembly 52 which includes, in relatively fixed positions, various strainer members 500. As illustrated more clearly in FIG. 4, the various strainers may comprise an 8-hole strainer member 502, a fine mesh (approximately a No. 20 sieve size) wire cloth strainer member 504, a coarse mesh (approximately a No. 12 sieve size) wire cloth strainer member 506, and a 55-hole strainer member 508. The strainer assembly 52 functions to provide a final straining of the cushion gum material 20 to ensure that no lumps exist and to capture any out-sized contaminates which might be present.

The output from the strainer assembly 52 is fed through a die head assembly 54 which forms the hot cushion gum extrudate into a thin ribbon 517 having the desired thickness, width, and cross-sectional configuration. A size and configuration for the ribbon which has proven to be particularly satisfactory can be provided by a representative die head assembly 54 having the structural arrangement illustrated in FIGS. 5-8. The die head assembly 54 has a gate

housing 514 which carries a thickness control gate 522. The thickness control gate 522 may be moved vertically by a control knob 515 (FIG. 3). By moving the thickness control gate 522 vertically with respect to the gate housing 514 the thickness of the extruded ribbon 517 of cushion gum material 20 may be precisely controlled. A representative thickness "t", as indicated in FIG. 5, which has been determined to work quite well, falls within the range of from about 0.055 to about 0.062 of an inch (1.397 to 1.574 mm).

As best seen in FIG. 7, the bottom edge 522a of the thickness control gate 522 may be convexly arcuate. Typically, the arcuate edge 522a is defined by a radius of about 10 inches (25.4 cm). While it might appear that the convexly arcuate configuration would militate against forming the desired taper along the lateral edges of the ribbon 517, it has been found that the arcuate disposition tends to equalize the velocity of the cushion gum material across the full width of the ribbon 517 as it exits from the extruder 30. Without the convexly arcuate bottom edge 522a the central portion of the ribbon 517 exits the extruder 30 more quickly than the lateral edges, resulting in the formation of ripples on the top and bottom surfaces of the ribbon 517.

The die head assembly 54 is also provided with a width control gate 519, as best seen in FIGS. 3, 5 and 8. The width control gate 519 has a pair of control edges 520a and 520b which extend divergently outwardly, one with respect to the other. The width control gate 519 may be moved vertically by a control knob 516. Vertical movement of the width control gate 519 selectively positions the divergent control surfaces 520a and 520b with respect to the die gate opening 518 precisely to determine the width of the extruded ribbon 517.

The divergent control edges 520a and 520b also serves to form a taper along the lateral edges of the extruded ribbon 517 so that successive wraps of the ribbon 517 may be overlapped without incurring any appreciable increase in the overall thickness of the material applied to the tire carcass 12. The actual width of the taper, as measured from the lateral edge toward the center of the ribbon 517, will depend upon the extent of overlap desired, but preferably such overlap should not be more than approximately 0.250 of an inch (6.350 mm). In practice an overlap of about 0.187 of an inch (4.750 mm) is both attainable and is preferable. The aforesaid taper is determined by the angle at which the control edges 520a and 520b diverge. Typically, an inclination angle θ of approximately 20° will provide the taper necessary to achieve the desired overlap.

It should also be observed that the gate housing 514, as depicted in FIG. 5, is typically about one inch (2.54 cm) thick and has an inclined surface 514a which converges upwardly toward the bottom edge 522a of the thickness

control gate 522 to terminate in the lower die forming edge 514b. The die forming edge 514b determines the length of the die gate opening 518, which, as depicted, may be on the order of about 0.3 inches (0.76 cm). The utilization of an inclined surface 514a minimizes the frictional contact between the gate housing 514 and the gum material 20 as it is being formed into the ribbon 517. Without using the inclined configuration the temperature of the cushion gum material is increased by about 10° F. (5.5° C.) merely by the interaction of the cushion gum material 20 with the gate housing 514. The use of the inclined surface 514a thereby eliminates the increase in temperature through the delivery sub-assembly 50 and permits a higher temperature within the screw housing 32.

Upon leaving the die gate assembly 54, the ribbon 517 of cushion gum material 20 is passed to a tension roller 56 and a pair of guide rollers 58. This combination maintains the limit of stretch of the hot extrudate to an acceptable level. For example, a stretch of no more than approximately ten percent (10%) has been found to be quite acceptable. From the guide rollers 58 the ribbon of cushion gum passes to an apply roller 530 which is substantially cone-shaped, the base of the cone being toward the start position of the cushion gum lay-up on the tire carcass 12. In this manner, the apply roller 530 will conform to the surface contour across the crown 12a of the carcass 12 as the carcass is indexed about axis A-A.

Almost immediately after the ribbon 517 of hot cushion gum material 20 is applied to the crown 12a of the tire carcass 12, the ribbon 517 is mechanically stitched to the carcass by a gimballed roller mechanism 540. More specifically, and with reference to FIGS. 9 and 10 of the drawings, the stitching roller 540 comprises a housing 542 which carries a slidable roller support 544 therethrough. The slide support 544 is mounted within the housing 542 via a pair of tension springs 546 which produce a force of a predetermined magnitude acting in the direction designated by arrow A_1. The mounted stitching roller 548 applies that force to the cushion gum ribbon 517 as it is laid on the crown 12a of the tire carcass 12. The roller 548 is mounted to the slidable support 544 via a shaft 550 and a transversely positioned pivot pin 552. The roller 548 comprises an inner cylindrical portion 554 and an outer sleeve portion 556, the inner portion 554 being carried on the pivot pin 552 while the sleeve portion is mounted for rotation about the inner portion 554 by way of bearings 558. Retaining rings 560 maintain the position of the inner cylindrical portion 554, and retaining rings 562 maintain the position of the sleeve via the bearings 558. Because of this gimballed support for the roller 540, precise stitching of the cushion gum ribbon

517 is accomplished as the tire carcass rotates during application of the cushion gum ribbon 517.

When the full circumferential surface of the crown 12a has been covered with the hot, cushion gum material 20, the gum ribbon 517 is cut, and the tire carcass 12 is rotated 90°, about axis A-A, in preparation for the application of a new, pre-cured tire tread 62. FIG. 2 of the drawings illustrates this by way of the phantom representation indicated by reference numeral 60 wherein tread stock 62 is positioned for application to the tire carcass. During this phase of the retreading process the tire carcass 12 is also rotated by the apparatus 14 as the pre-cured tread 62 is applied by the worker to the surface of the previously applied hot cushion gum material 20.

A cutting means 64 is used to sever the tread stock 62 for splicing, after which the tire carcass 12 is rotated back to its original position shown in solid lines in FIG. 1. A tread stitching mechanism 66 then roller stitches the pre-cured tread stock 62 to the tire carcass 12. The stitching mechanism comprises a stationary roller 68 and a pair of transversely movable rollers 70, as is also illustrated in FIG. 1. The pressure applied by the stitching mechanism 66 to force the tread stock into the desired contact with the cushion gum material 20 previously wound onto the crown 12a is provided by an air cylinder 72 which draws the stitching rollers transversely across the surface of the retreaded tire carcass 12 as the carcass 12 is rotated by the apparatus 14. Finally, the retreaded tire carcass 12 is positioned within a well known curing chamber (not shown) wherein the cushion gum material 20 is cured to effect an integral bond between the tread stock 62 and the tire carcass 12.

Microprocessor controller 40 stores programs for required widths and controls indexing of the rotating tire carcass about the vertical axis A-A, and may also furnish other operational control over the functions of work station 10. One suitable, exemplary microprocessor controller may be found in the system known as the ORBITREAD®, Model 2001, commercially available from Steelastic West, Inc. of Buena Park, California.

As should now be apparent, the present invention not only teaches that the cushion gum by which a pre-cured tread stock may be bonded to a tire carcass can be effectively extruded onto the crown of a prepared tire carcass but also that the other objects of the invention can likewise be accomplished.

CLAIMS

1. A process for applying a pre-cured tread stock to a tire carcass in a retreading operation including the sequential steps of:

rotating a tire carcass about an axis;

extruding a continuous ribbon of cushion gum material across the crown of the rotating tire carcass;

maintaining the temperature of the ribbon of cushion gum material above ambient but below that at which the cure of the cushion gum is initiated;

stitching the applied ribbon to the tire carcass;

applying a pre-cured tread stock over the cushion gum applied to the crown of the tire carcass; and,

thereafter curing the cushion gum, whereby the tread stock becomes bonded to the tire carcass.

2. The method, as set forth in claim 1, comprising the further step of:

indexing the rotating tire carcass about an axis which is normal to, but displaced from, that axis about which the tire carcass is rotated such that the cushion gum is laid up in a continuous spiral about the circumferential extent across the crown of the tire to a predetermined and programmable width.

3. The method, as set forth in claim 1, comprising the further step of:

buffing the crown of the tire carcass;

mounting the buffed tire carcass such that the axis about which it rotates will be transverse to the extrusion of the cushion gum ribbon; and,

inflating the tire.

4. The method, as set forth in claim 2, comprising the further step of:

roller stitching the applied ribbon of hot cushion gum to the tire carcass at the point at which the ribbon is applied.

5. The method, as set forth in claim 4, comprising the further step of:

applying an adhesive to the buffed tire carcass prior to the application of the hot cushion gum.

6. The method, as set forth in claim 5, comprising the further step of:

overlapping the spirally applied ribbon of cushion gum along its lateral edges.

7. The method, as set forth in claim 5, comprising the further step of:
overlapping successive winds of the spirally applied ribbon of cushion gum no more than about 0.25 of and inch.

8. The method, as set forth in claim 2, comprising the further step of:
forming tapered edges along the lateral edges of the ribbon of cushion gum.

9. The method, as set forth in claim 2, comprising the further step of:
masticating the cushion gum stock in the extruder at a temperature within the range of from about 180° F. (83° C.) to about 205° F. (96° C.).

10. The method, as set forth in claim 9, comprising the further step of:
feeding the hot, masticated cushion gum through a No. 12 mesh wire cloth.

11. The method, as set forth in claim 9, comprising the further step of:
feeding the hot masticated cushion gum successively through a No. 12 mesh wire cloth and a No. 20 mesh wire cloth.

12. Apparatus for retreading a tire carcass having its tread removed and the circumferential extent of the crown buffed in preparation for retreading comprising, in combination:
an extrusion apparatus;
means to mount the tire carcass in position relative to the extrusion apparatus such that the tire carcass can be rotated about its normal axis of rotation and such that the crown of the tire carcass can be indexed with respect to an axis normal to the rotational axis thereof;
means to feed cushion gum material into the extrusion apparatus;
means associated with the extrusion apparatus for maintaining the temperature of the cushion gum material within a predetermined range of temperatures, the upper temperature limit being below the cure initiation temperature of the cushion gum compound;
said extrusion apparatus having an output;

means at the output of said extrusion apparatus to strain the cushion gum extrudate and to form it into a continuous ribbon having a predetermined thickness, width, and cross-sectional configuration;

means mounted relative to the crown of the tire carcass to apply the ribbon of cushion gum to the crown;

control means to rotate and simultaneously index the tire carcass such that the cushion gum extrudate is positioned on the tire carcass in a continuous spiral across the crown of the carcass according to a predetermined and programmable width;

means to stitch the cushion gum ribbon onto the tire carcass immediately after its point of application on the carcass;

a pre-cured tire tread band for mounting over the cushion gum compound on the tire carcass; and,

means to cure the cushion gum compound to effect an integral bond of the tread to the tire carcass.

13. The apparatus, as set forth in claim 12, wherein:

the means at the output of said extrusion apparatus for forming the extrudate of hot cushion gum compound into a continuous ribbon has an adjustable die gate with a die opening configuration which results in a ribbon having a cross-sectional configuration that tapers at the lateral edges.

14. The apparatus, as set forth in claim 13, wherein:

a width control plate is movable within a gate housing to control the die opening;

said width control plate having a pair of divergently outwardly extending control edges;

means selectively to position said width control plate precisely to control the width of the extruded ribbon and to provide tapering lateral edges thereon.

15. The apparatus, as set forth in claim 13, wherein:

a thickness control plate is movable within a gate housing to control the die opening;

said thickness control plate having a convexly arcuate bottom edge to effect a uniform velocity, across the full width of the extrudate, at which the extrudate exits the extrusion apparatus.

16. The apparatus, as set forth in claim 15, wherein:

said gate housing has a lower die forming edge disposed in opposition to said convexly arcuate bottom edge on said thickness control plate;

an inclined surface is provided on said gate housing which converges upwardly toward said thickness control plate;

said inclined surface terminating at said lower die forming edge to direct the extrudate through the output of said extrusion apparatus and thereby minimize the temperature increase of the extrudate caused by interaction between the extrudate and said extruder output.

17. A process for applying a pre-cured tread stock to a tyre carcass in a retreading operation substantially as herein described with reference to the accompanying drawings.

18. An apparatus for retreading a tyre carcass substantially as herein described with reference to the accompanying drawings.

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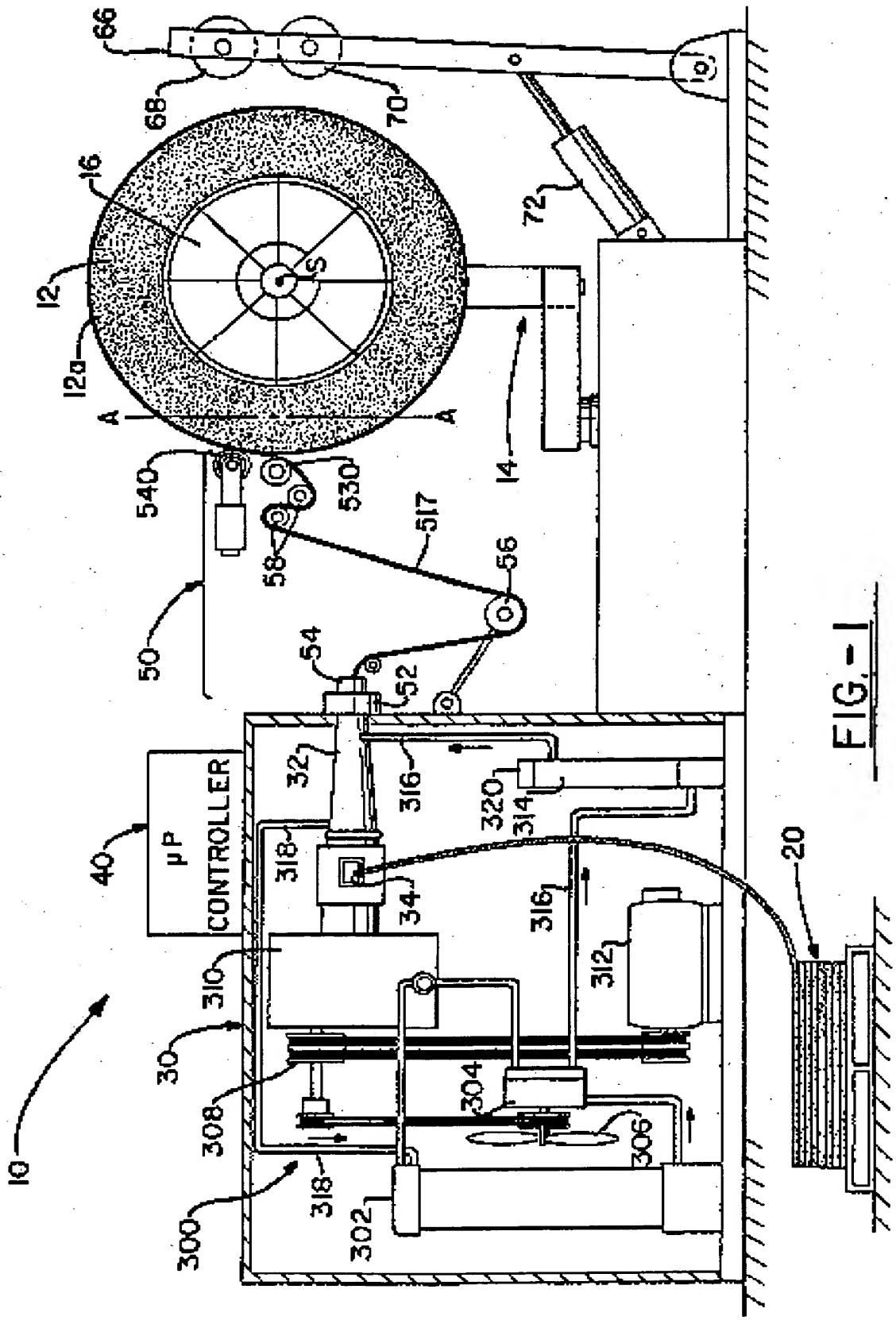

FIG. - 1

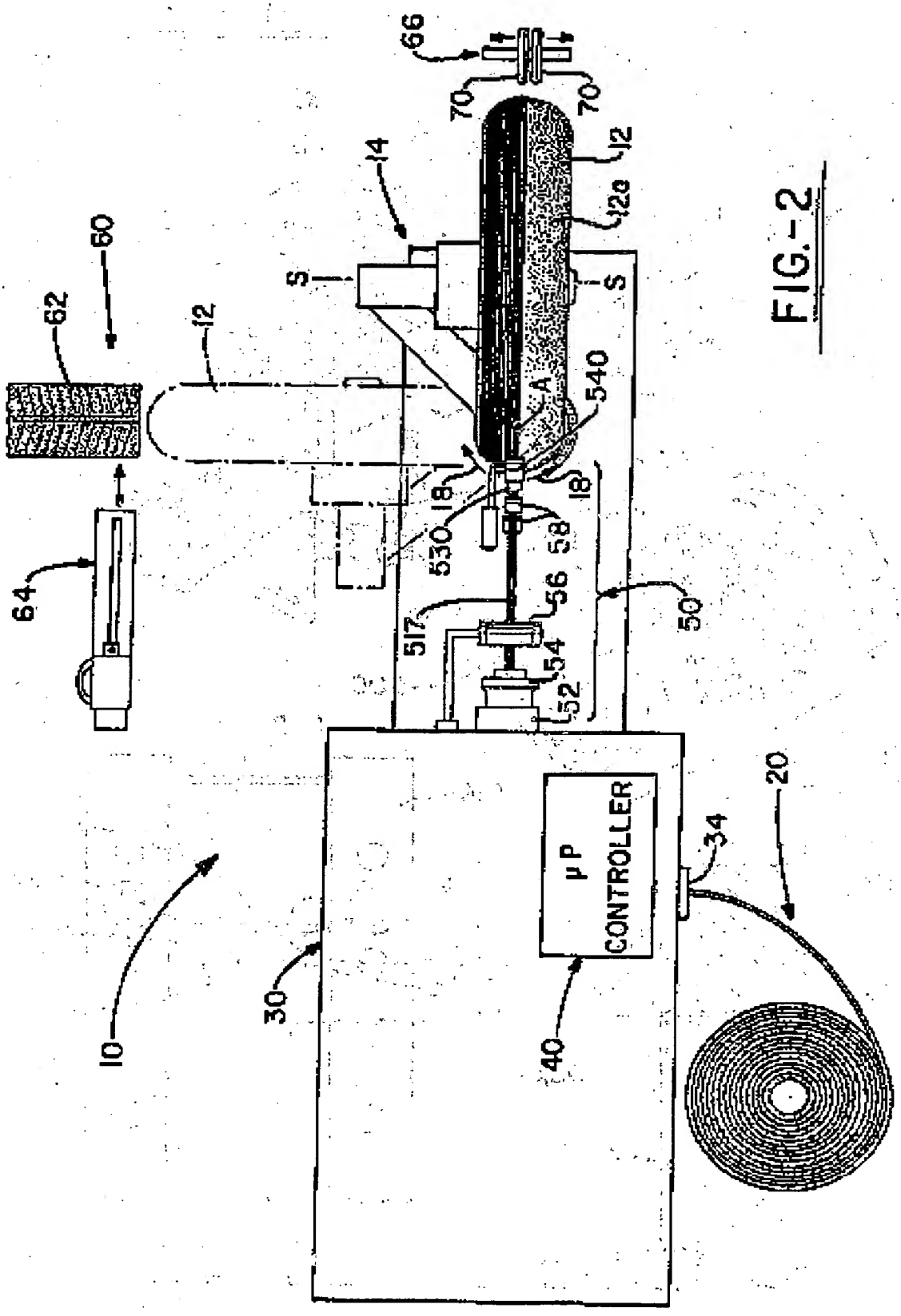

FIG.-2

FIG.-3

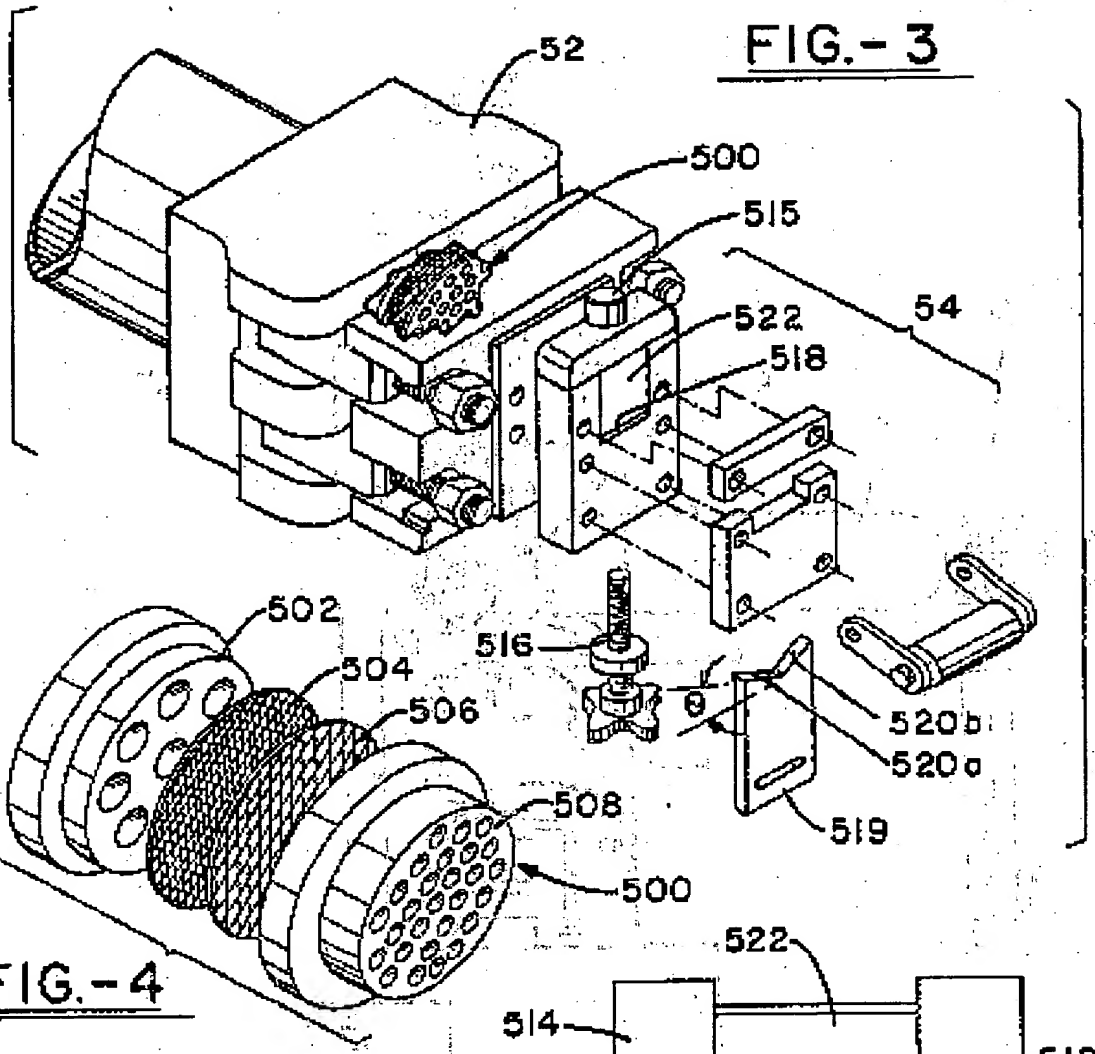

FIG.-4

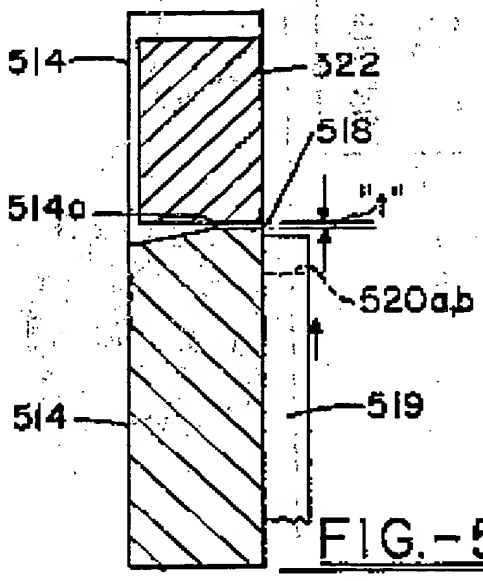

FIG.-5

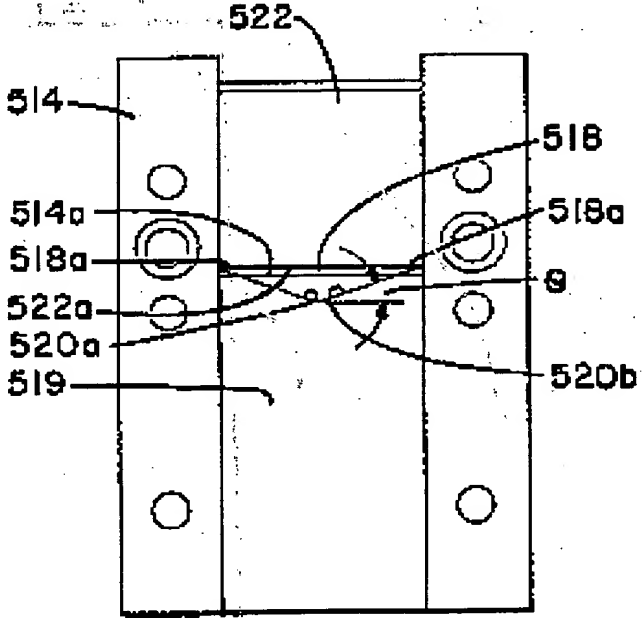

FIG.-6

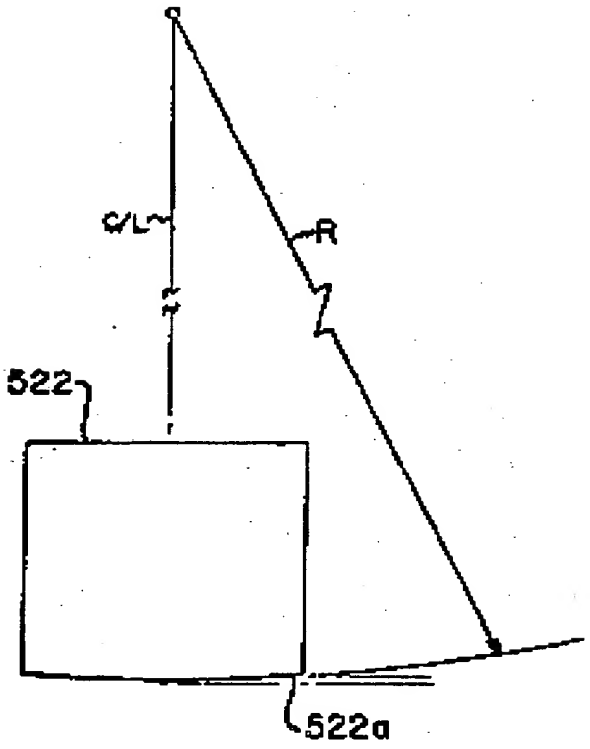

FIG.-7

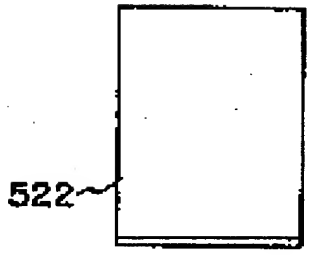

FIG.-8

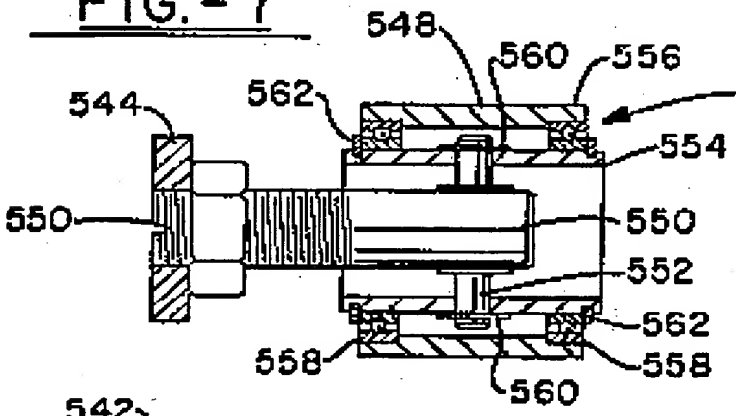

FIG.-9

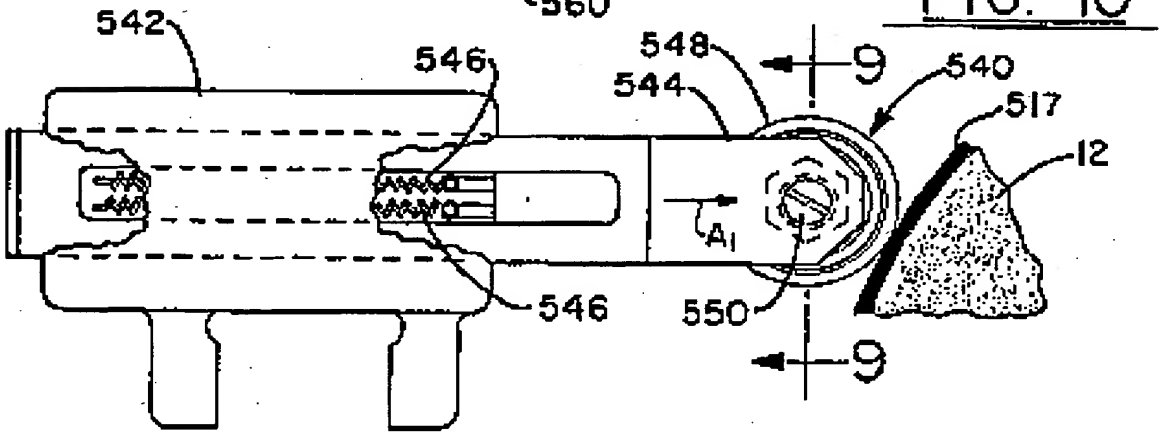

FIG.-10